Energy efficiency on the European residential sales market: a meta-analysis

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Sustainable Finance Network: ESG risks in the Pillar 1 prudential framework

Is there a risk differential regarding ESG risks in banks’ mortgage portfolios?

- **Physical risks**: acute or chronic climate events can deteriorate buildings. Houses market values plummet hence worsening the borrower’s ability to service their loans payments.

- **Transition risks**: Energy inefficient dwellings targeted by environmental regulation become stranded assets on the market.

Property Price differentials relating to energy efficiency can influence the risk profile of a mortgage through LTV and LGD factors.
Introduction and motivation

What is the added value of a meta-analysis?

Investigating green premium on the real estate market
  • Acknowledge it’s existence
  • Assess it’s magnitude

Profusion of literature on the impact of energy performance on property prices.

Focus of the analysis.
  • Real estate market
  • More specifically on the sales market
What’s at stake?

Alighani, Reed (2020): ”The underlying idea is that by pooling estimates across many studies, we get a more reliable estimate than by relying on any single study”
Building the Meta-Base

Updating two existing meta-bases, based on Kahn et al. (2003) methodology.

- What is the impact of energy efficiency performance on house prices?
- ”EPC Green Premium”, ”Green label housing”, ”EPC hedonic premium”. Google Scholar, Science Direct
- What makes a study relevant? the presence estimates and standard errors.
Retrieving the estimate and the standard error

1. The estimate: look for Hedonic models (Rosen 1974)

\[ \log(p) = \alpha + \beta E + \delta X + e \]  

▷ p, price of the dwelling  
▷ E, measure of energy efficiency  
▷ X vector of control variables, Rosen (1974)

2. The standard error: not systematically disclosed!

▷ No SE in the study but the t-statistic is given:

\[ SE = \frac{\beta}{t} \]  

No SE, no t-statistic, also turned out to be relevant for studies not disclosing the t-statistic but the confidence interval (Notaires de France).
The baseline methodology

Fixed effects model

- Assumption: total variability in the individual results are exclusively the outcome of sampling error → absence of true heterogeneity.

Random effects model

- Assumption: total variability in the individual results is the outcome of sampling error and methodological heterogeneity → presence of true heterogeneity. "the percentage of total variation across studies that is due to heterogeneity rather than chance" - Higgins et al. (2003)

$$W_i^* = \frac{1}{V_{Y_i}^*} = \frac{1}{V_{Y_i} + T^2}$$

- $V_{Y_i}$ is the within study variance.
- $T^2$ is the between study variance.

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Estimation and results

Overall premium:

\[ 8.79\% \]
\[ [0.0784; 0.0974] \]

High level of heterogeneity, \( I^2 = 97.19 \) which strongly supports the need for a meta-regression. The goal is to investigate the drivers of this heterogeneity in research.
Meta-analysis: Forest plot
Meta-regression - Hypotheses

1. Primary studies with a higher "distance to EPC reference" are expected to report a higher premium

\[ premium_i = \alpha + \beta_1.distrat_i + \epsilon_i \]  

(3)

2. There is a significant negative relationship between the level of grouping and the premium, i.e: the higher the number of grouped categories, the lower the reported premium for the group.

\[ premium_i = \alpha + \beta_1.group_i + \eta_i \]  

(4)

3. Estimates reported in scientific papers might be of different magnitude than that of estimates from non-scientific papers. i.e: due to different publishing processes.

\[ premium_i = \alpha + \beta_1.publi_i + \gamma_i \]  

(5)

where \( \epsilon, \eta \) and \( \gamma \) are the respective error terms in equations (3), (4) and (5).
Meta-regression moderators

The set of moderators is the same as those collected by Cespedes-Lopes (2020)

\[
Z = \begin{bmatrix}
\text{non-labeled - comparison} \\
\text{building} \\
\text{neighborhood} \\
\text{location} \\
\text{market} \\
\text{construction date} \\
\text{published}
\end{bmatrix}
\]

A meta-regression was performed on the set of moderators to determine which were relevant, using the F-test.
Results and robustness

<table>
<thead>
<tr>
<th>Variables</th>
<th>Estimates</th>
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<th>pval</th>
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<tbody>
<tr>
<td>Intercept</td>
<td>0.07165</td>
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<td>Distance</td>
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<td>Published</td>
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<td>Neighbourhood controls</td>
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<tr>
<td>Market controls</td>
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</table>
Bottom line

As can be expected, robust meta-regression results do affect the conclusions previously drawn.

- Lower significance level: 10%
- Similar magnitude
- New result: *non-labeled* coefficient is now significant at the 5% level. (needs to be further investigated).
**Discussing the results**

1. **Limited model performance:**
   - Explanatory power of the model is just above 25%
   - High degree of heterogeneity
   - More moderators are needed

2. **Negative relationship between EPC bands group sizes and the level of the premium.** Hypotheses:
   - Mechanical effect: grouping more implies to reduce the distance to the reference band.
   - Heterogeneity between groups with one band diluting the others.

3. Policy implications